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Preparation and Characterization of g-C_3N_4 /ZnO for Ofloxacin Degradation Under Visible Light Irradiation

Nur Amirah Balqis Mohd Kosim[a], Nor Fadilah Chayed[a*]

Structured Abstract

Background: The aim of this study is to clarify the synthesis and characterization of g-C_3N_4/ZnO composites as photocatalysts for the degradation of ofloxacin, which is an antibiotic known to be a pollutant with significant environmental concerns. The aim of this research work is the thermal decomposition synthesis of g-C_3N_4, sol-gel process synthesis of ZnO, and synthesis of their composite using wet impregnation.

Methods: Analysis equipment such as X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), and ultraviolet-visible spectroscopy confirmed that the heterojunction synthesis of g-C_3N_4/ZnO had been a success. Characterization was done using X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), and ultraviolet-visible spectroscopy (UV-Vis). X-ray diffraction pattern findings revealed that g-C_3N_4/ZnO heterojunctions were successfully synthesized, as confirmed from peaks corresponding to improved crystallinity and phase purity. FESEM images indicated that ZnO particles were uniformly distributed across g-C_3N_4, which resulted in the increase of the surface area for photocatalytic activity. According to UV-Vis spectroscopy, absorption in the visible light range was determined to be enhanced.

Results: Aside from this, a composite material containing 50% g-C_3N_4/ZnO content indicated an optimum redshift and bandgap of 3.22 eV. This resulted in increased charge transfer and less electron-hole recombination. Photocatalytic activity was determined using a light source that consisted of LEDs with an output power of 150 watts with special emphasis on the different ratios of ZnO and g-C_3N_4 in ratios of 25%, 50%, and 75% g-C_3N_4/ZnO. Most impressively, the most photocatalytically efficient composite was in the proportion of 50% g-C_3N_4/ZnO and showed a degradation of 75% of ofloxacin within 240 minutes. Precisely, this is due to the ability of the heterojunction to enhance charge separation, suppress electron-hole recombination, and improve light absorption.

Conclusion: In conclusions, the results demonstrate that g-C_3N_4/ZnO composites represent a promising option for wastewater remediation with both environmental friendliness and economic feasibility. This agrees with the observed findings. The research offers critical insight into photocatalytic materials applied in the purification of water contaminated by antibiotics, thereby facilitating the innovation of green water treatment technologies.

Keywords: Photocatalyst, ofloxacin, degradation, heterojunction, recombination

*Correspondence: norfadilah6231@uitm.edu.my

[a] School of Applied Chemistry, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia

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[a] School of Applied Chemistry, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia